

# Concept and Operation of the Performance Data Analysis and Reporting System (PDARS)

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## ABSTRACT

Since 1999 the Federal Aviation Administration (FAA) has been operating a prototype system for the collection, analysis, and reporting of performance-related data from the National Airspace System (NAS). This Performance Data Analysis and Reporting System (PDARS) has been installed at ten Air Route Traffic Control Centers (ARTCCs), five Terminal Radar Approach Control facilities (TRACONs), two Regional Offices, and the FAA's Air Traffic Control System Command Center in Herndon, Virginia. The system generates and distributes over 100 reports daily for these facilities.

PDARS calculates a range of performance measures, including traffic counts, travel times, travel distances, traffic flows, and in-trail separations. It turns these measurement data into information useful to FAA facilities through an architecture that features (1) automatic collection and analysis of radar tracks and flight plans, (2) automatic generation and distribution of daily morning reports, (3) sharing of data and reports among facilities, and (4) support for exploratory and causal analysis.

PDARS applications at FAA facilities include performance measurement, route and airspace design, noise abatement analysis, training, and support for search and rescue. PDARS has also been used in a range of FAA and NASA studies. Examples are the measurement of actual benefits of the Dallas/Fort Worth (DFW) Metroplex airspace, an analysis of the Los Angeles Arrival Enhancement Procedure (AEP), an analysis of the Phoenix Dryheat departure procedure, measurement of navigation accuracy of aircraft using area navigation (RNAV) en route, and a study on the detection and analysis of in-close approach changes.

## INTRODUCTION

PDARS provides FAA air traffic control (ATC) decision makers at the facility level with a dynamic set of previously unavailable comprehensive tools and methods for monitoring the health, quality, and safety of day-to-day ATC operations. PDARS enables the FAA to measure the performance of its air traffic services, as

required by congressional mandates. In addition, PDARS analytic software enables processing of complex and extremely large datasets as well as reliable extraction of relevant information, allowing FAA users to quickly focus on operationally significant problems. The FAA's Office of System Capacity (ASC) and the National Aeronautics and Space Administration (NASA) have sponsored the development of PDARS. ATAC Corporation in Sunnyvale, California, is the primary contractor supporting the PDARS program. ATAC's role includes systems engineering, software development and deployment, system monitoring, training, and user support.

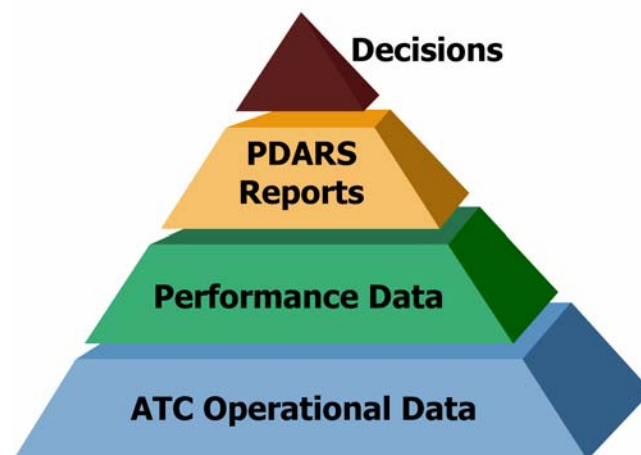


Figure 1. PDARS turns vast amounts of ATC operational data into reports supporting system improvement decisions.

## FAA PERFORMANCE INITIATIVES

Driven by the Government Performance and Results Act (GPRA) of 1993<sup>1</sup>, the FAA has launched several initiatives to measure performance of the air traffic services that it delivers to the operators of aircraft flying through the NAS. In its Air Traffic Services Performance Plan<sup>2</sup>, the FAA Office of Air Traffic Services (ATS) describes its objectives, accomplishments, and plans for measuring and improving its aviation services.

Three specific ATS performance initiatives are managed by ASC:

- En Route Metrics, studying ATS performance for the en-route portion of flights, focusing on major city pairs.
- Balanced Scorecard, designed to ensure the safe, secure, efficient operation, maintenance, and use of the air transportation system; maximize utility of the airspace resources; and meet future challenges to increase system safety, capacity, and productivity.
- Facility-Level Metrics, focusing on Point of Service Delivery, and supporting all levels of management.

There are various ways in which PDARS supports these performance initiatives:

- PDARS collects information on the ATS product quality. Factual data on flights through the NAS are translated into accurate performance measurements and other useful information and delivered at the Points of Service Delivery, as well as at regional and national levels.
- PDARS provides data to populate parts of the Balanced Scorecard Strategy Map with information necessary for strategy monitoring and implementation.
- PDARS provides tools for measurement development, automatic reporting, traffic visualization, and exploratory analysis.
- PDARS maintains an archive of facility data to enable trend analysis, baseline development, data mining, statistical analysis, and analysis of modernization initiatives.

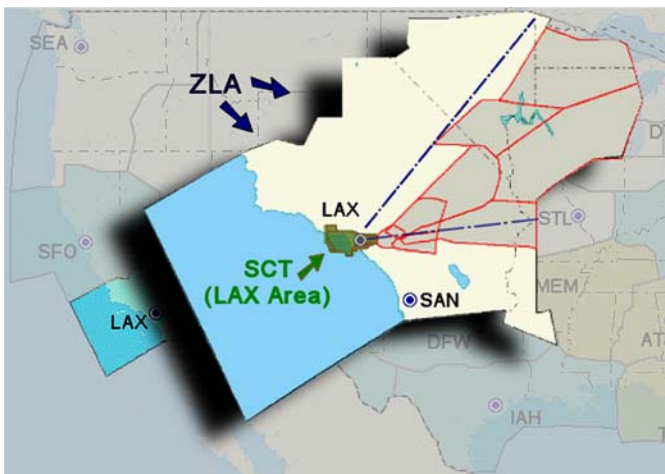


Figure 2. PDARS provides accurate performance measurements at the Points of Service Delivery, i.e. the ATC sectors. Sectors shown include Los Angeles Center sectors for LAX arrivals and the LAX area within the Southern California TRACON airspace.

## NASA INVOLVEMENT

NASA has been a key partner in PDARS from early on in the program. The Human Factors Research and Technology Division and the Computational Sciences Division of the NASA Ames Research Center actively participate in user needs analyses and the design, implementation, and management of significant PDARS components. The PDARS wide-area network (WAN) is built and managed by NASA Ames. Under the Aviation System Monitoring & Modeling<sup>3</sup> (ASMM) sub-element of the Aviation Safety Program<sup>4</sup> (AvSP), PDARS data and analytic tools have been used in safety-oriented studies. NASA has evaluated the application of Aviation Performance Measuring System (APMS) tools<sup>5</sup> to radar track data provided by PDARS and has prototyped the integration of flight-recorded data (from APMS) with radar-track data (from PDARS). PDARS components are also being used in the Air Traffic Operations Laboratory (ATOL) at the NASA Langley Research Center. Under the DAG-TM element of the Advanced Aviation Technology Transfer (AATT) program<sup>6</sup>, the PDARS-derived Data Processing and Analysis Toolset (DPATS) is used to analyze real-time simulation results recorded in the ATOL<sup>7,8</sup>.

Earlier this year, PDARS was recognized by NASA's Office of Aerospace Technology for its contribution toward meeting NASA's aeronautics goals and objectives. On June 11, PDARS received the Administrator's Award at the 2003 Turning Goals into Reality (TGIR) Conference in Williamsburg, Virginia. The Administrator's Award is the most prestigious of the TGIR awards, which recognize the year's top teams for their significant contributions to NASA's aeronautics and space objectives<sup>9</sup>.

## PDARS HISTORY AND USE

Work on PDARS started in 1997. A first lab prototype, supporting off-line data processing, was demonstrated in 1998. The first live radar data tap was brought on line at the Southern California TRACON (SCT) in 1999. In the same year, NASA completed the first round of user needs analyses. In close collaboration with the National Air Traffic Controllers Association (NATCA), NASA conducted many interviews of potential PDARS users. The results of these interviews provided the framework to bring other facilities in the Western Pacific Region on line during 2000. The second users needs study was completed in 2001, paving the way for installation in the Southwest Region in 2001-2002. Installation in the Southern Region is in progress and should be completed before the end of FY03.

Through newsletters, teleconferences, and quarterly meetings, ASC has actively encouraged the participation of all stakeholders, including FAA facility management, Air Traffic personnel, Airways Facilities personnel, and collective bargaining units. In March 2002, NATCA and the FAA signed a Memorandum of Understanding (MOU) concerning PDARS. This MOU limits the use of

PDARS data to the measurement of FAA's overall performance under the GPRA and support for facilities in enhancing the design of airspace, traffic flow, and procedures. A separate MOU between the Professional Airways Systems Specialists (PASS) and the FAA is under negotiation.

PDARS is currently in use at 15 operational FAA facilities, 2 regional offices, and at the ATCSCC. Over the next few years, PDARS is expected to grow to a nationwide implementation, supporting 20 Air-Route Traffic Control Centers (ARTCCs) and many TRACON facilities.

The system supports a variety of FAA facility functions, including Plans and Procedures (route and airspace design, and noise abatement analysis), Training (traffic flow and airspace familiarization, and training scenario development), Traffic Management (initiative review and assessment, and system measurement) and Search and Rescue (locating lost aircraft). Through its strong visualization capabilities, PDARS is also an extremely important tool for interfacing with the public and airspace users.

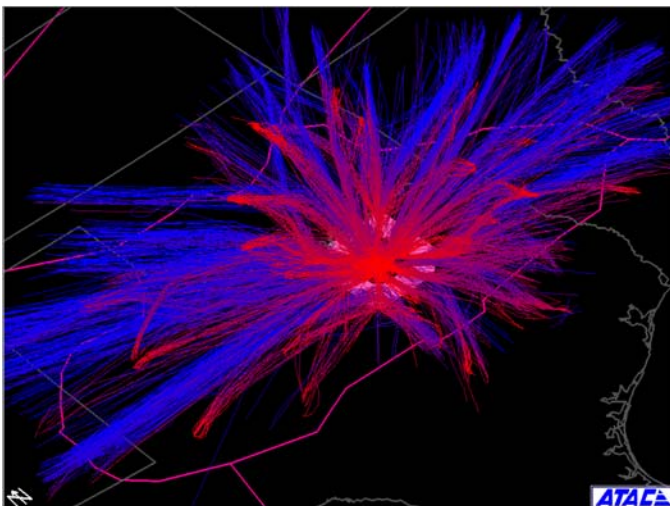


Figure 3. Visualization of one day of flights to and from Dallas/Fort Worth International Airport, color coded by altitude (red - low altitude, blue - high altitude).

PDARS has also been used in several FAA airspace studies led by ASC. Examples are measurement of the actual benefits of the DFW Metroplex airspace, an analysis of the Los Angeles AEP, an analysis of the Phoenix Dryheat departure procedure, and measurement of navigation accuracy of aircraft flying RNAV en route. In a NASA study, PDARS was used for the detection and analysis of in-close approach changes.

## PAPER OUTLINE

The rest of this paper describes the breadth and depth of the PDARS system and its use by FAA personnel at connected facilities. The system concept is described first, focusing on the architecture and key features. This is followed by a more detailed description of PDARS usage at the facilities, a description largely based on anecdotes and presentations made by PDARS users at the quarterly users meetings.

## PDARS CONCEPT

PDARS is a distributed, component-based system that provides end-to-end data collection, processing, reduction, analysis, reporting, visualization, publishing, distribution, and archiving capabilities for air traffic control data. The system accomplishes these tasks on a continuous basis with a high degree of automation, accuracy, and reliability. With a few exceptions, the components of the system operate on personal computers running Microsoft Windows.

PDARS measurements are based on the processing of data collected from Automatic Radar Terminal System (ARTS) computers at the TRACONs, and data collected from the Host computers at the ARTCCs. These data sources provide a much more accurate traffic picture than the Enhanced Traffic Management System<sup>10</sup> (ETMS) or its commercial counterpart ASDI (ASD Feed for Industry), widely used for analysis and visualization of air traffic data.

Besides its high degree of accuracy, a key advantage of PDARS is the simple way in which data can be accessed. It maintains approximately 45 days worth of data on line for each facility. New data are available on a next-day basis and loading data files is simple and fast. Data beyond the 45-day horizon are archived and available for special studies. Following a set of distribution and access rules, facilities can also share data with one another. This allows one facility to view the data from surrounding facilities and get a broader understanding of system behavior and measurements.

Through its reporting subsystem and Graphical Airspace Design Environment (GRADE) components, PDARS provides users with a set of interactive analysis tools for report viewing, track visualization, air traffic replay, detailed exploratory analysis, customization of measurements, and seamless publication of numerical and graphical results. PDARS is fully integrated with the Microsoft Office suite of office productivity tools.

The next few sections describe the various PDARS components in more detail.

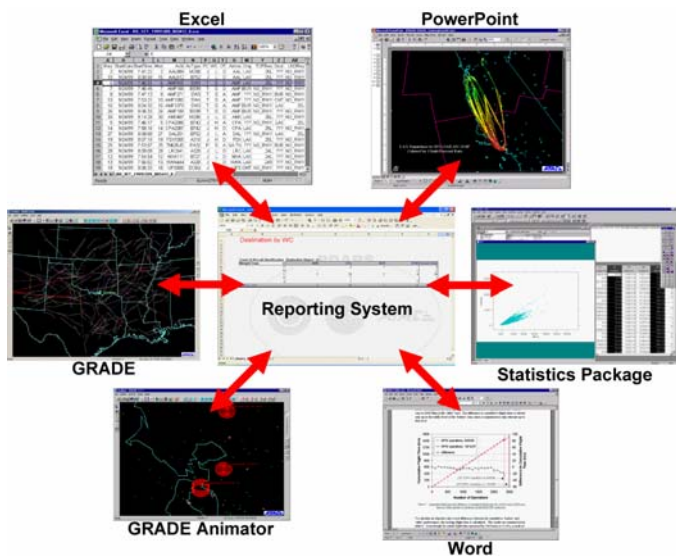


Figure 4. PDARS Reporting System and GRADE, tightly integrated with office productivity tools.

## AUTOMATIC COLLECTION AND ANALYSIS OF RADAR TRACKS AND FLIGHT PLANS

PDARS continuously collects radar track and flight plan data directly from ARTS and Host computer gateways. Figure 5 illustrates this automated data collection, analysis and reporting chain, and the underlying data management component. PDARS supports many different on-line and off-line data sources, including:

- ARTS IIIA, connected through the optical disk subsystem (ODS) gateway
- Common ARTS, connected through the Common ARTS gateway
- Host data, connected through the HID-NAS-LAN (Host interface device-NAS-local-area network)
- ETMS data, connected through an ASDI feed

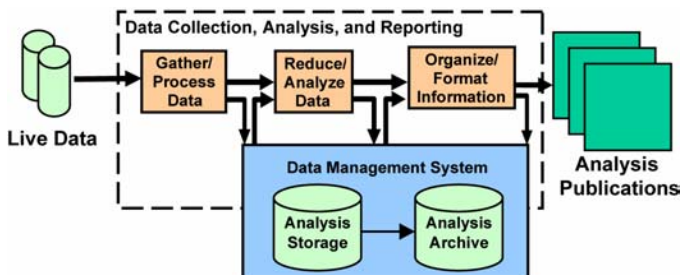


Figure 5. Automatic Data Collection, Analysis, and Reporting with underlying Data Management System.

In a process often compared to the un-shredding of shredded paper, PDARS correlates and merges track points and flight plans for each flight that passes through

the system. It stores the resulting flight data and subjects each flight to an analysis process in an attempt to find the key events that occurred for each flight in the system<sup>11</sup>. Typical events that are calculated on a routine basis include takeoff, sector boundary crossings, facility boundary crossings, top of climb, top of descent, fix crossings, and landing. The results from this analysis process are stored in the data management system for later use in the generation of reports. This data management system also stores the definitions of the sector boundaries, airports, runways, fixes, and other airspace elements that are necessary for the detailed analysis of each flight.

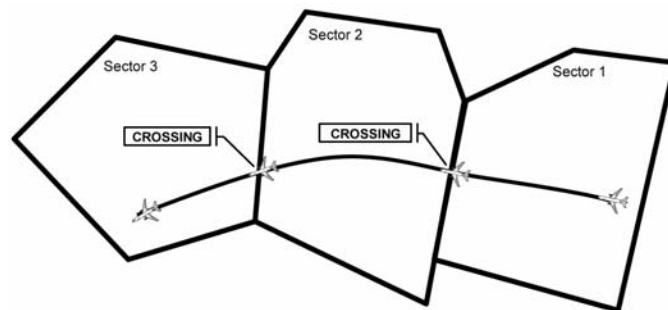


Figure 6. Example of sector boundary crossing events.

In addition to these routine events, PDARS can be configured for the detection and measurement of user-defined events and segments. Examples are the measurement of flight time and distance from a facility boundary to a specific arrival fix, or a traffic flow analysis of flights departing from a specific airport and/or runway and crossing a particular departure fix.

## AUTOMATIC GENERATION AND DISTRIBUTION OF DAILY REPORTS

The factual data coming out of the data collection, flight synthesis, and flight analysis provide the source for the daily reports. The system automatically generates daily reports and makes them available for viewing by the time that facility personnel need to attend their daily morning briefing with the Command Center and other facilities. The reports provide daily performance measures, but can also be used to detect and flag unusual flights in the system. Multi-day reports provide information for trend analyses, and multi-facility reports can be used to roll-up results to regional or even national level.

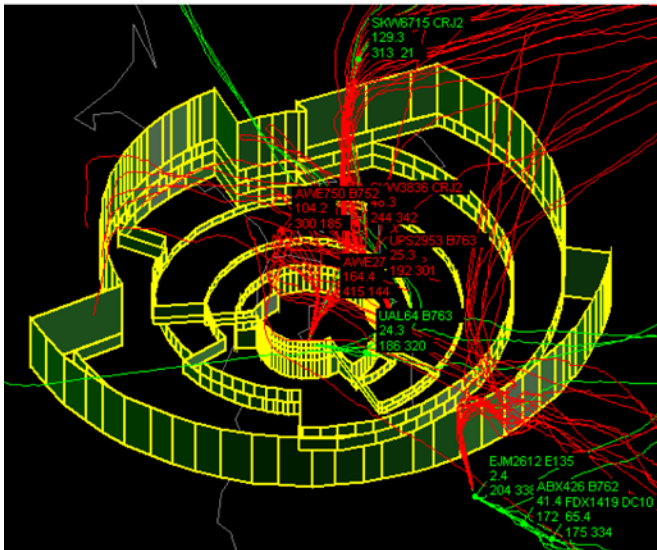
The reporting component of PDARS is a Microsoft Excel-based application that allows users to quickly and dynamically design custom reports based on data created by PDARS analysis components and stored in an ASCII flat-file database or an Oracle database. Facility users can create tables and charts that allow them to turn their facility's data into useful information. The reports give facility managers access to a wealth of

performance measures, which heretofore was unavailable. Reports can be set up as reusable templates, or can be designed and generated on an ad-hoc basis.

## TRAFFIC VISUALIZATION WITH GRADE

Through the Graphical Airspace Design Environment (GRADE), PDARS provides a two- or three-dimensional display of static and dynamic (replay) views of airspace and air traffic.

The basis for this functionality is a powerful set of functional modules housed within an easy-to-use graphical user interface (GUI). Through this GUI, the user has access to airspace and air traffic data and to a set of functional tools for visual and quantitative analysis, preparation of simulation models of current or proposed operations, replay of radar data and simulation results, airspace design and modification, and computation of performance measures for actual or simulated air traffic operations.



- Northern California TRACON (NCT)
- Southern California TRACON (SCT)
- Phoenix TRACON (P50)
- Western Pacific Regional Office (AWP)

In the Southwest Region:

- Albuquerque Center (ZAB)
- Houston Center (ZHU)
- Fort Worth Center (ZFW)
- Dallas/Fort Worth TRACON (D10)
- Houston TRACON (I90)
- Southwest Regional Office (ASW)

In the Southern Region:

- Jacksonville Center (ZJX)
- Memphis Center (ZME)
- Atlanta Center (ZTL)
- Miami Center (ZMA)

In the Great Lakes Region:

- Indianapolis (ZID)

At the national level:

- ATC System Command Center (ATCSCC) in Herndon, Virginia

Data collection is on-line at all Centers and TRACONS, except for ZLA, ZMA and ZTL. Those facilities are expected to be on line within the next few months.

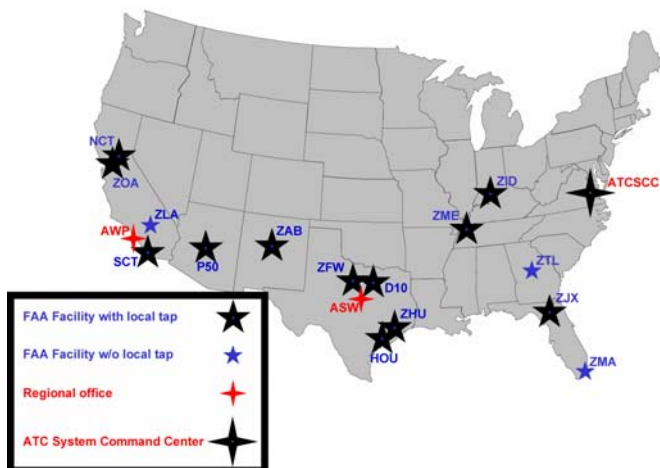


Figure 8. PDARS installations as of July 1, 2003.

The next few sections provide more details with respect to the use of PDARS for daily reporting, facility-specific applications, and special studies.

## PDARS REPORTS

The number of daily reports generated automatically by PDARS and distributed among the facilities now exceeds 100. This number is growing steadily and includes:

- 62 reports generated daily at the sites with local data taps
- 70 reports generated daily at the central site, for sharing among facilities
- 12 reports generated daily at the central site for data quality monitoring

Each report consists of one or more pages, with each page containing a query table, a summary table, a summary chart, or a traffic picture. In the latest version of the PDARS reporting system, which is now in use at most of the PDARS facilities, the reports are based on Excel workbooks, with each report page a worksheet in the workbook.

There are three different types of reports: daily reports, trend reports, and special reports. The following sections provide further detail about these types.

### Daily PDARS Reports

The bulk of the reports are daily reports, typically designed to cover one day of traffic operations for one facility. They are designed to provide daily performance data on specific performance measures, or to highlight unusual flights. A separate set of reports was developed to support monitoring of data quality and integrity on a daily basis.

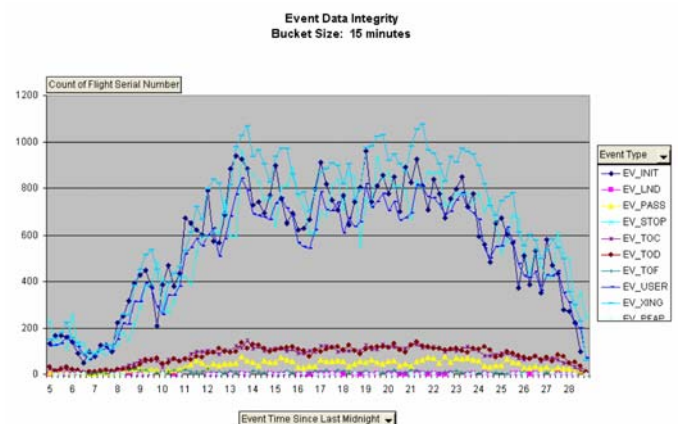


Figure 9. Sample chart from a data integrity report.

### Trend Reports

Trend reports are designed to provide data over an extended period, allowing users to track performance measures over time. In addition, they allow for other

types of analysis to be performed such as control charting and outlier determination. Typical trend reports capture information for one week or one month but longer analysis time-frames are possible with PDARS.

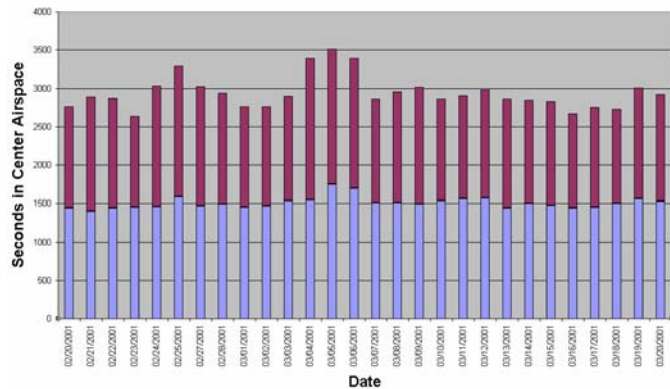


Figure 10. Analysis of daily flight time for one month of flights from San Francisco International Airport to Los Angeles International Airport. Bars show sum of time spent in ZOA airspace (light/blue) and ZLA airspace (dark/red).

In a recent proof-of-concept study, sector flight times were analyzed over a time span of more than two years. The study focused on flight times within center airspace for ZOA and ZLA. Sector transit flight times were analyzed for all flights from San Francisco International Airport (SFO) to Los Angeles International Airport (LAX). Using PDARS reporting components, flight times were examined on an aggregate basis and broken down by individual sectors within ZOA and ZLA airspace. During the course of the study, several days were designated as “outliers” for further study, since flight times on those particular days were more than three standard deviations from the mean over the entire two-year time frame.

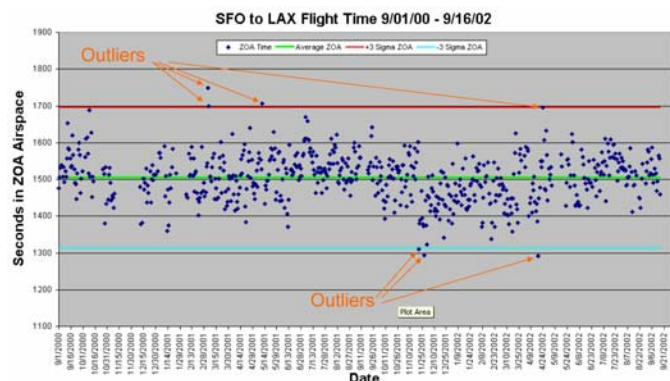


Figure 11. Two-year flight time trend analysis on flights from San Francisco International Airport to Los Angeles International Airport.

## Special Reports

Special reports are designed to answer very specific one-time questions, often related to a comparison of traffic operations before and after an operational change was made. An example is an analysis that was done by Oakland Center in conjunction with Bay TRACON (which is now part of NCT), where the PANOCH standard terminal arrival route (STAR), used for Oakland arrivals, was replaced by the MARVN STAR. While greatly improving the traffic flow through the airspace of those two facilities, the study showed a slightly longer flight time for the airspace users, a tradeoff that often occurs when trying to improve overall operations.

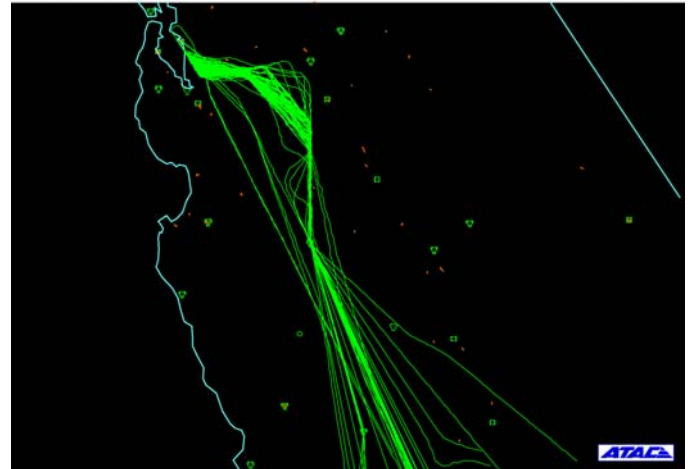


Figure 12. MARVN STAR arrivals to Oakland International Airport.

## PDARS APPLICATIONS

Innovative users at the facilities continue to generate new ways to use the system as it evolves, and the possibilities appear to be limitless. So far, PDARS has been used to support a wide variety of facility functions, including plans and procedures, training, traffic management, and even search and rescue. PDARS is also an extremely important tool for interfacing with the public and air traffic users.

The following sections describe a few of those applications. The descriptions are largely based on anecdotes and presentations made by PDARS users at the quarterly PDARS users meetings.

### Plans and Procedures

Typical PDARS uses for plans and procedures have included development of new routes and airspace design. An example is the design of the Los Angeles off-shore route to LAX (the LENNA STAR). This new route was designed jointly by the National Airspace Redesign<sup>13</sup> (NAR) teams from ZOA, ZLA and SCT. Even though the new LENNA arrival is longer than the original

## Training

[illegible]

## Traffic Management

## Support for Airspace Users

## Community Support

LAX departure flows.  
3-05-03 8:00-8:50AM.  
Alignment of tracks on map is not exact.

Red	= 00-50
Orange	= 50-100
Green	= 100-150
Blue	= 150-200
Purple	= 200+

Figure 15. Analysis of flight tracks in response to community inquiries (source: SCT).

### Inter-Agency Coordination

FAA facilities often interact with and provide support for other government agencies, such as the Department of Defense and the Department of Homeland Security. An example is the use of PDARS to analyze the potential impact of temporary flight restrictions.

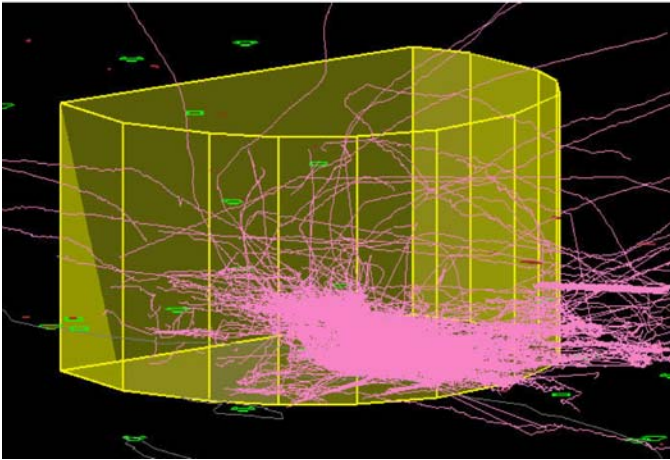


Figure 16. Analysis of traffic operating under Visual Flight Rules (VFR) that could be affected by proposed airspace restrictions (source: SCT).

### Support for Search and Rescue

In one case at SCT, PDARS was used to locate a missing aircraft. A pilot had changed destination without notifying air traffic control, and an Alert Notice (ALNOT) was sent out to facilities to try to locate the airplane. Rather than listening to controller-pilot voice communication tapes, PDARS was used to quickly determine where the track of the flight terminated. Subsequently, the plane and pilot were located without further need for search and rescue efforts.

### PDARS STUDIES

Since the inception of PDARS, the system has been used for several detailed traffic analysis studies.

#### DFW Metroplex Analysis

In October 1996, several major airport and airspace changes went into effect at the Dallas/Fort Worth (DFW) Metroplex. These changes included the addition of a new runway 17L/35R at the Dallas/Fort Worth International airport, a redesign of the boundaries of the DFW TRACON, and rearrangement of feeder fixes, arrival routes, and departure routes. The changes to the DFW Metroplex were designed to accommodate a significant expansion of air traffic volume to and from the DFW area, while at the same time maintaining a high quality of service to the airspace users.

PDARS was used in a 1998 study to quantify the effect on aircraft operations associated with the use of the new Metroplex<sup>16</sup>. For a detailed comparison of the performance of the DFW Metroplex before and after October 1996, six full-day traffic samples of System Analysis Recording (SAR) and Common ARTS radar data were collected at the Fort Worth ARTCC and the DFW TRACON.

#### LAX Dual CIVET Arrivals

To improve the traffic flow for westbound arrivals from the east into Los Angeles International Airport, a two-fix arrival procedure was put in place, referred to as the Dual CIVET arrival enhancement procedure (AEP). PDARS was used to analyze the differences in the traffic flows before and after the AEP was put in place.

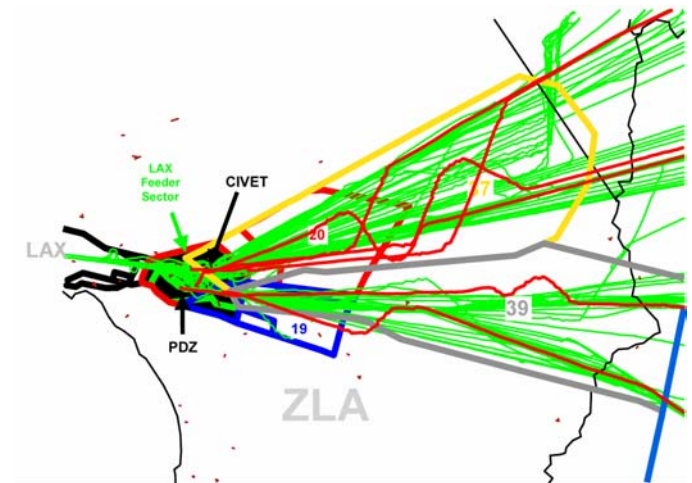


Figure 17. LAX Arrival Traffic following dual CIVET arrival procedures.

#### Phoenix Preheat Departures

In April 2000, a one-month test was conducted to determine the benefits of a proposed southbound departure procedure, referred to as the Preheat departure, for Phoenix Sky Harbor International Airport. Twenty days of before-Preheat traffic were compared with twenty-nine days of traffic under the new procedure. As part of this study, PDARS data were merged with OAG (Official Airline Guide) data, and OOOI data (out, off, on, in data) from a local airline. After this successful test, the departure procedure was made operational under the name Dryheat (DRYHT).

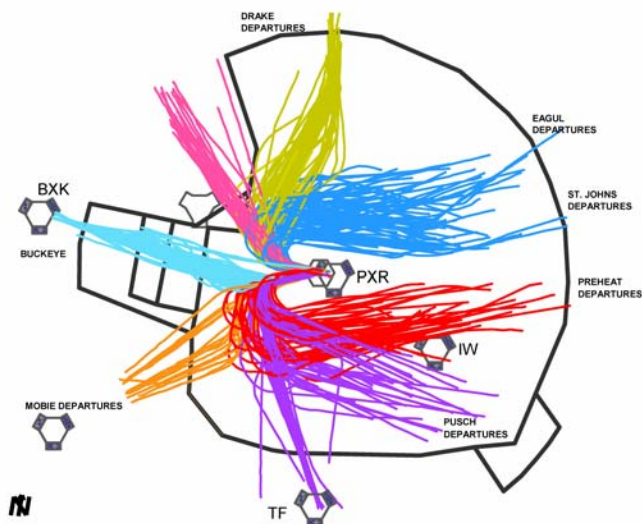


Figure 18. Phoenix departures off of runways 26L/R. Preheat departures are in dark/red.

### Analysis of In-Close Approach Changes

Under the Aviation Safety Program, NASA has been exploring the application of various analysis and data mining technologies to flight data from flight data recorders and ATC radar data. As part of that effort, PDARS was used to provide data collection and analysis for a safety study involving the detection of in-close approach changes (ICACs) to parallel runways at San Francisco International Airport and Los Angeles International Airport.

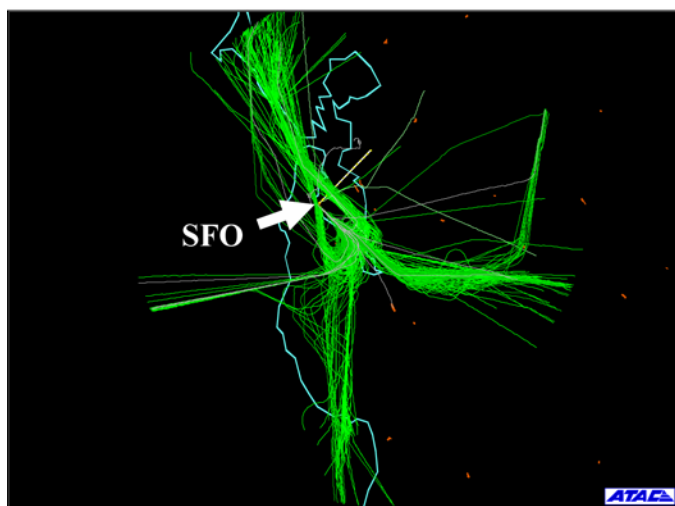


Figure 19. Sample arrival flow to San Francisco International Airport, used for the analysis of in-close approach changes.

The period of data collection spanned one month of operations at each airport. In addition to summary statistics, key information and measurements produced by PDARS during the analysis included: original landing runway, final landing runway, time of cross-over

maneuver, distance from landing runway threshold at time of cross-over maneuver, localizer and glide slope deviations during the ICAC, number of proximity traffic take-offs and landings near the cross-over time, and any resulting situations (go-arounds) possibly related to the ICAC<sup>17,18</sup>.

### Data Collection for Flight Standards Determination

In February 2003, the Flight Technical Programs Division of the FAA's Flight Procedure Standards Branch, AFS-420<sup>19</sup>, undertook an investigation to determine RNAV route separation requirements for the en-route flight track portion of RNAV-equipped aircraft. The goal of the study is to produce published criteria for the widths of, and separation distances between, RNAV routes so that appropriately equipped aircraft could safely navigate along such routes<sup>20</sup>.

PDARS was used to collect the data for the study, centering on two RNAV routes running from Houston to southern Florida through Jacksonville ARTCC (ZJX) airspace. A portion of routes Q100 and Q102 was selected so that only RNAV equipped aircraft would use them and where issuance of direct-to clearances could be curtailed for the duration of the test. On-site monitoring of the traffic situation ensured that any aircraft vectored off its assigned route could be excluded from the analysis.

Nearly 1,000 flights traversing the Q-routes were automatically logged and analyzed by PDARS. Information for analysis provided by PDARS on a daily basis included aircraft position, ground speed, call sign, flight plan route, and aircraft type and equipment. In addition, PDARS calculated cross-track deviation at three nautical-mile intervals for each aircraft as it navigated the Q-routes. The PDARS data were forwarded to AFS-420 in Oklahoma City, Oklahoma, for data reduction and further statistical analysis.

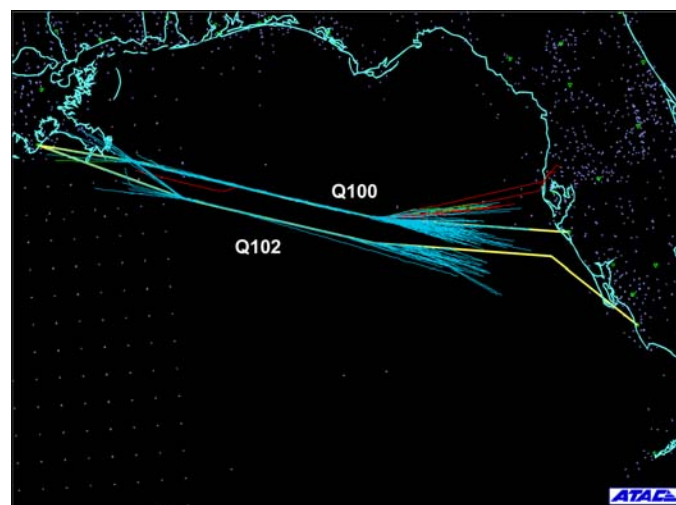


Figure 20. Sample traffic on the RNAV routes Q100 and Q102 over the Gulf of Mexico.

Although the analysis of PDARS-generated data for the Q-route test is still ongoing, the RNAV study application has already demonstrated the versatility of PDARS for measuring performance in the NAS. In this case, PDARS was quickly configured for this particular application without a need for new software or hardware. It showed its ability to perform measurements in more diverse ways than initially envisioned.

## CONCLUSION

Two years after its inception, a PDARS prototype was up and running at SCT. Installation at Bay TRACON, Los Angeles Center and Oakland Center soon followed, providing geographic coverage for the busy West-coast corridor between the San Francisco Bay Area and Southern California. Since then, the system has expanded to include facilities in the Southwest Region, the Southern Region, and the Great Lakes Region.

A key factor for the success of PDARS is that it is a joint FAA/NASA effort. This ensures better engineering and better science. Whereas the FAA focuses more on the short-term needs of the users, NASA allows the program to look at the longer term as well.

Another success factor is the iterative approach to developing the program. This iterative development goes beyond current software “best-practices.” The philosophy is not just to “build a little, test a little,” but to “build a little, test a little, and use.” New features are selected based on user requests, and all enhancements quickly find their way to the users, who very rapidly take advantage of the improvements.

From listening to the users, productivity is the one area that stands out in terms of benefits of PDARS. Putting data and tools at the fingertips of the users, PDARS reduces the time users need to search for data. Instead, they can focus on the information they need. Tight integration with office productivity tools allows the users to quickly package and disseminate that information in a professional way.

PDARS itself has also shown a remarkable increase in productivity. Using off-line data collection, ATAC used to generate, at most, twelve air traffic datasets per year. With current on-line processing, PDARS generates twelve datasets per day, automatically, and with very high accuracy.

Quarterly users meetings have provided a powerful forum for sharing information and driving further development of the system. All FAA stakeholders are invited to participate in these meetings, including facility management, NATCA representatives, and personnel from Air Traffic and Airways Facilities. These meetings give users from all facilities a chance to present how they use PDARS and to share results with other users. Many users take the opportunity to request new system features that would help them solve their problems even more effectively.

Now that PDARS has matured, it is time to expand it to more FAA facilities, to make it a true nationwide system, and to start adding other sources of data to be used for reporting and causal analysis. The future could include:

- Expansion of the number and type of reports generated by the system.
- Expansion of the geographic area covered by the system, to include all ARTCCs, and all major TRACONs.
- Expansion of the sources of data available for analysis. Weather data, airline schedules, and operational data such as flow restrictions should all be added to enhance reporting and explanatory analysis.
- Expansion of features, to keep up with all ideas in the user community for better performance measurements, better statistical analysis, and new ways of visualization.

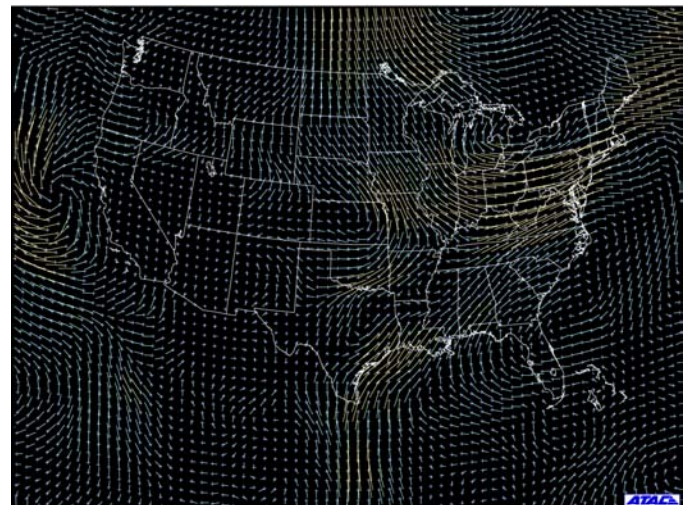


Figure 21. Example of a wind vector field overlaid on GRADE.

NASA can play a significant role in this feature expansion. A number of NASA tools developed under AvSP/ASMM could be used in PDARS, most notably the APMS Profiler data clustering tool<sup>5</sup>, the morning reports, and technologies developed under the Aviation Data Integration Project<sup>21</sup> (ADIP).

From ATAC's perspective, PDARS brings together many organizations within the FAA and many organizations within NASA. PDARS is the result of this cooperation and, with its high technology-readiness level of the core components, provides a strong foundation for continued support of the FAA's performance measurement initiatives as well as NASA's Aviation Safety and Airspace Systems Programs<sup>4, 22</sup>.

## ACKNOWLEDGMENTS

The authors wish to thank all PDARS users at the various FAA facilities, who have all contributed to shaping the PDARS system as it is now, and who continue to shape the system as it evolves.

The authors also wish to thank the following people for their stories and materials used in this paper: Rich Gutterud, Traffic Management Officer, Southern California TRACON; Christian Anderson, Traffic Management Coordinator, Southern California TRACON; Clayton Smith, Special Operations and Automation Liaison, Albuquerque ARTCC; Jim D'Ambrosio, Air Traffic Manager, Houston ARTCC; David Frame, Traffic Management Officer, Houston ARTCC.

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## DEFINITIONS, ACRONYMS, ABBREVIATIONS

**AATT:** Advanced Air Transportation Technologies

**ADIP:** Aviation Data Integration Project

**AEP:** arrival enhancement procedure

**ALNOT:** alert notice

**APMS:** aviation performance measuring system

**ARTS:** automated radar terminal system

**ASC:** FAA Office of System Capacity

**ASD:** air traffic situation display

**ASDI:** ASD feed for industry

**ASMM:** Aviation System Monitoring & Modeling

**ARTCC:** Air Route Traffic Control Center

**ATC:** air traffic control

**ATCSCC:** ATC System Command Center

**ATM:** air traffic management

**ATOL:** Air Traffic Operations Laboratory

**ATS:** FAA Office of Air Traffic Services

**AvSP:** Aviation Safety Program

**CMS:** common message set

**CTAS:** Center-TRACON Automation System

**DAG-TM:** distributed air-ground traffic management

**DPATS:** Data Processing and Analysis Toolset

**ETG:** Enhanced Target Generator

**ETMS:** Enhanced Traffic Management System

**FAA:** Federal Aviation Administration

**GPRA:** Government Performance and Results Act of  
1993

**GRADE:** Graphical Airspace Design Environment

**GUI:** graphical user interface

**HID:** host interface device

**ICAC:** in-close approach change

**LAN:** local-area network

**MOU:** memorandum of understanding

**NAR:** National Airspace Redesign

**NAS:** National Airspace System

**NASA:** National Aeronautics and Space Administration

**NATCA:** National Air Traffic Controllers Association

**OAG:** Official Airlines Guide

**ODS:** optical disk subsystem

**OOOI:** out, off, on, in

**PASS:** Professional Airways Systems Specialists

**PDARS:** Performance Data Analysis and Reporting  
System

**RNAV:** area navigation

**SAR:** system analysis recording

**STAR:** standard terminal arrival route

**TBM:** time based metering

**TGIR:** Turning Goals Into Reality

**TMA:** Traffic Management Advisor

**TRACON:** Terminal Radar Approach Control

**VFR:** visual flight rules

**WAN:** wide-area network

Correct reference information for this publication is:

den Braven, W., Schade, J., "Concept and Operation of the Performance Data Analysis and Reporting System", SAE Advances in Aviation Safety Conference (ACE), Montréal, September 8-12, 2003, paper number 2003-01-2976.